Beetle Visitors to Flowers of *Angophora hispida* (Sm.) D. Blaxell (Myrtaceae) and some other *Angophora* in the Sydney Region

G. A. Webb — Forestry Commission of NSW Wood Technology and Forest Research Division, P.O. Box 100, Beecroft 2119.

INTRODUCTION: The dwarf apple, *Angophora hispida* (Sm.) D. Blaxell (given as *A. cordifolia* Cav. in older literature), is a shrub or small tree of dry sclerophyll forest and woodland of the Sydney Basin (Elliot and Rogers 1982; Beadle *et al.* 1983; Leach 1986). During summer, when it flowers, *A. hispida* is a mass of sweet smelling white blossom and highly attractive to insects (Armstrong 1979; Froggatt 1907; Musgrave 1951). The congeneric rough-barked apple *Angophora floribunda* (Sm.) Sweet and narrow-leaved apple, *Angophora bakeri* C. Hall, from similar habitats, may also flower profusely during spring and summer, though few records of insect visitation are available (see Hawkeswood 1978; Williams and Williams 1983).

Hawkeswood (1981) studied the pollination ecology of *Angophora woodsiana* F. M. Bail in south-eastern Queensland and concluded that beetles played a substantial role in pollination. It would, therefore, be interesting to compare the pollination ecology of other *Angophora* spp. with *A. woodsiana.*

During the summers of 1982, 1983 and 1985, insects were observed on and collected from the flowers of *A. hispida, A. floribunda* and *A. bakeri* at a number of localities near Sydney, New South Wales.

MATERIALS AND METHODS

Collection localities and examination dates are given below:

1. *Angophora hispida*

(a) Cheero Point near Brooklyn (33° 31′S, 151° 12′E) (23 November 1982). Scattered *A. hispida* on roadside and derelict land in typical Hawkesbury Sandstone complex vegetation.

(b) Alfords Point near Menai (34° 00′S, 151° 12′E) (3 December 1983, 10 December 1985). Scattered *A. hispida* on roadside together with *Kunzea ambiqua* (Sm.) Druce, *Eucalyptus gummifera* (Soland. ex Gaertn.) Hochn. and *Eucalyptus haemastoma* Sm.

2. *Angophora bakeri*

Woronora River near Sutherland (34° 02′S, 151° 03′E) (3 December 1983). Scattered small *A. bakeri* on roadside together with *E. gummifera, Angophora costata* (Gaertn.) Druce and *Elaeocarpus reticulatus* Sm.

3. *Angophora floribunda*

Dundas (33° 47′S, 151° 03′E) (30 November 1983). Remnant tall trees in cleared area along roadside.

Insects were either observed on flowers *in situ* or collected using a manually operated aspirator or by hand.

RESULTS AND DISCUSSION

Forty-one species of Coleoptera were recorded from the flowers of *A. hispida, A. bakeri* and *A. floribunda.* By far, the greatest number of species were recorded from *A. hispida.* This difference may be largely attributed to sampling intensity although *A. hispida* was in much heavier bloom (at all three sites) than *A. bakeri* or *A. floribunda.* Unidentified species of Hymenoptera (Scoliidae), Diptera (Lauxaniidae), Lepidoptera (Armatidae) and Hemiptera were also recorded from *A. hispida* flowers as were large numbers of the introduced honeybee *Apis mellifera* (L.).

Other than beetles (Anon 1976; Armstrong 1979; Clifford and Drake 1979; Froggatt 1894, 1907; Hawkeswood 1978, 1981; Leach 1986; Musgrave 1951; Nikitin 1969, Williams and Williams 1983), ants, bees, flies, wasps, butterflies and grasshoppers (Armstrong 1979; Clifford and Drake 1979; Leach 1986; Michener 1965; Musgrave 1951; Prakash 1969; Rayment 1932, 1935; Rentz and Clyne 1983) and vertebrates such as birds and bats (Nelson 1963; Ratcliffe 1931; Recher and Abbott 1970) have been recorded visiting *Angophora* spp. flowers. It is clear that a diverse fauna is associated with *Angophora* flowers. However, it remains largely uncertain to what extent these groups contribute to pollination.

Hawkeswood (1981) suggests that *Angophora woodsiana* F. M. Bail. has all the attributes of a beetlepollinated plant. This appears to be true also of *A. hispida* which has large dish and bowl type flowers (sensu Faegri and Van der Pijl 1979) as well as readily accessible and attractive pollen and nectar. Although *A. floribunda* and *A. bakeri* have identical floral structure, flowers are small and the plants examined were not in massive bloom.

Nectar and pollen production vary among species of *Angophora* (Clemson 1985). *A. hispida, A. bakeri* and *A. floribunda* all produce copious quantities of nectar in favourable conditions. However *A. hispida* produces only minimal amounts of pollen, while *A. bakeri* and *A. floribunda* produce abundant pollen. This suggests that there may be some difference in the pollinator arrays of *Angophora* spp. *A hispida* may attract primarily nectar seeking insects while *A. bakeri* and *A. floribunda* may attract a combination of nectar and pollen seeking insects. Unfortunately there are insufficient data on insect visitors to some *Angophora* spp. making it difficult to assess differences in their pollinator arrays.

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Table 1: Beetles observed on *Angophora* flowers.

	Angophora hispida			*Angophora bakeri*	*Angophora floribunda*
	C	A1	A2		
Alleculidae					
Aethyssius viridus Boisduval		C	U		
Buprestidae					
Stigmodera rufipennis (Kirby)		R			
Stigmodera sexplagiata Gory			R		
Stigmodera sexguttata Macleay		R			
Stigmodera subpura Blackburn		R			
Cantharidae					
Chauliognathus nobilitata Erichson		R			
Selenus sydneyanus Blackburn	U	U			
Cleridae					
Eleale nr. *simplex* Newman			R		
Eleale nr. *viridus* Guérin		R		U	
Phlogistus rufipes Macleay		U			
Phlogistus sp.			U		
Cleromorpha novemguttata Westwood		R			
Chrysomelidae					
Ditropodus sp.		U			
Monolepta nr. *setipennis* lea				U	
Curculionidae					
Eugnomus sp.		U			
Elateridae					
Agonischius basilaris Candèze	U				
Lycidae					
Metriorrhynchus rhipidius Macleay		C			
Mordellidae					
Mordella inusitata Blackburn				U	
Mordella limbata Waterhouse		C		C	C
Mordella nr. *limbata* Waterhouse		R			
Mordella sydneyana Blackburn		C		C	
Mordella nr. *tristis* Lea		C		C	C
Mordella wiburdi Lea				R	
Mordella spp.			R	R	
Mordellistena longipes Lea		R			
Tomoxia aterrima Macleay		R			
Nitidulidae					
Circopes vagans Lea		R			
Phalacridae					
Litochrus sp. 1		R			
Litochrus sp. 2		U		R	
Scarabaeidae					
Cacochroa gymnopleura Fischer		U		U	
Cheiragra ruficollis Macleay	U				
Eupoecila australasiae Donovan			R		
Glyciphana brunnipes (Kirby)		C			
Microvalgus nigrinus Macleay		U			
Microvalgus nr. *vagans* Lea		R			
Polystigma punctatum Donovan				U	
Phyllotocus australis (Boisduval)	R				
Phyllotocus macleayi Fischer		A	U		
Phyllotocus marginipennis Macleay		C			
Phyllotocus scutellaris Macleay		A		C	C
Staphylinidae					
sp.		R			

Key: A = abundant (100 + individuals); C = common (11-100 individuals); U = uncommon (4-10 individuals); R = rare (1-3 individuals).
A1 = Alfords Pt. (3 December 1983); A2 = Alfords Pt. (10 December 1985); C = Cheero Pt. (23 November 1982).

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REFERENCES TO APPENDIX

1. Alderson (1976); 2. Anonymous (1976); 3. Armstrong (1979); 4. Froggatt (1894); 5. Froggatt (1907); 6. Froggatt (1914); 7. Hawkeswood (1978); 8. Hawkeswood (1981); 9. Musgrave (1951); 10. Nikitin (1979); 11. Willemstein (1978); 12. Williams and Williams (1983); 13. This study.

Appendix 1: Beetles recorded from *Angophora* spp. flowers (from various sources).

	Angophora species	Reference
Alleculidae		
Aesthyssius viridis Boisduval	AH	6,13
Buprestidae		
Cisseus duodecemmaculata Fabricius	AH	6
Cisseus notulata Germar	AH	12
Curis aurifera Laport and Gory	AH	6
Curis caloptera Boisduval	AF, AH	6,7,12
Cyria imperialis (Fabricius)	AH	6
Merimna atrata Hope	AH	12
Stigmodera affinis Saunders	AH	12
Stigmodera amplipennis Saunders	AH	6,12
Stigmodera andersoni Laport and Gory	AF, AH	6,7,12
Stigmodera armata Thomson	AH	12
Stigmodera australasiae Laport and Gory (= *assimilis)*	AH	6,12
Stigmodera bella Saunders	AB, AH	6,7,12
Stigmodera bifasciata (Hope) (= *bicincta)*	AB, AH	6,7,12
Stigmodera brutella Thomson	AF, AH	6,7
Stigmodera burchelli Laport and Gory	AH	12
Stigmodera costata Saunders	AH	12
Stigmodera crenata Donovan (= *amphichroa)*	AH	6,12
Stigmodera cruenta Laport and Gory	AB, AH	6,7,12
Stigmodera cruentata (Kirby)	AH	12
Stigmodera erythroptera (Boisduval)	AH	12
Stigmodera grandis (Donovan)	AH	12
Stigmodera indistincta Saunders	AH	6,12
Stigmodera jacquinoti Boisduval	AH	12
Stigmodera kerremansi Blackburn	AB, AH	6,7,12
Stigmodera kirbyi (Guérin)	AB, AH	7,12
Stigmodera klugi Laport and Gory	AH	6,12
Stigmodera limbata (Donovan)	AH	12
Stigmodera luteipennis Gory	AH	12
Stigmodera macularia (Donovan)	AH	6,9,12
Stigmodera moribunda Saunders (= *rotunda)*	AH	12
Stigmodera octomaculata Saunders	AH	12
Stigmodera octospilota Laport and Gory	AH	6,12
Stigmodera parallela White	AH	12
Stigmodera piliventris Saunders	AH	12
Stigmodera producta Saunders	AH	12
Stigmodera rectifasciata Saunders (= *vigilans)*	AB, AF	7
Stigmodera rufipennis (Kirby) (= *quadrifoveolata)*	AH	6,12,13
Stigmodera scalaris (Boisduval) (= *cyanicollis)*	AB, AH	6,7,12
Stigmodera semicincta Laport and Gory	AH	6
Stigmodera sexguttata Macleay	AH	12,13
Stigmodera sexplagiata Gory	AH	12,13

Appendix 1: continued.

	Angophora species	Reference
Buprestidae — continued		
Stigmodera spilota Laport and Gory	AH	6,12
Stigmodera spinolae Gory	AH	6
Stigmodera subpura Blackburn	AH	12,13
Stigmodera suturalis (Donovan)	AH	12
Stigmodera terminalis Kerremans	AH	12
Stigmodera thoracica Saunders	AF	10
Stigmodera tricolor (Kirby)	AH	12
Stigmodera undulata (Donovan)	AF,AH	6,7,12
Stigmodera variabilis (Donovan)	AF,AH	5,6,7,9,12
Stigmodera vertebralis Boisduval	AH	6
Stigmodera vicina Saunders	AH	6,12
Torresita cuprifera (Kirby)	AH	12
Cantharidae		
Chauliognathus pulchellus Macleay	AH	2
Chauliognathus nobilitata Erichson	AH	13
Chauliognathus sp.	AW	8
Selenus sydneyanus Blackburn	AH	13
Cerambycidae		
Aridaeus throacicus (Kirby)	AH,AW	6,8,9
Clytus curtisii Laport and Gory	AW	8
Clytus durvillei Laport and Gory	AW	8
Eroschema poweri Pascoe	AW	8
Hesthesis ferruginea (Boisduval)	AH	6
Hesthesis cingulata (Kirby) (= *murina*)	AH	6
Hesthesis vigilans Pascoe	AH	6
Phoracantha recurva Newman	AH	6
Stenocentrus ostricilla (Newman)	AW	8
Tragocerus fasciatus (Donovan)	AH	6
Tragocerus spencei Hope	AH	6
Trichomesia newmanii Pascoe	AH,AW	6,8
Uracanthus triangularis Hope	AH	6
Cleridae		
Phlogistus instabilis Newman (= *Aulicus instabilis)*	AH	6
Cleromorpha novemguttata Westwood	AH	5,13
Eleale nr. *simplex* Newman	AH	13
Eleale nr. *viridis* Guérin	AB,AH	13
Eleale sp.	AH	6
Phlogistus rufipes Macleay	AH	13
Phlogistus sp.	AH	13
Scrobiger sp.	AW	8
Zenithicola australis Boisduval	AH	6
Zenithicola crassus Newman (= *obesus)*	AH	6
Chrysomelidae		
Ditropodus sp.	AH	13
Monolepta nr. *setipennis* Lea	AB	13

Appendix 1: continued.

	Angophora species	Reference
Curculionidae		
Eugnomus sp.	AH	13
Oxyops reticulata Boisduval (= *cancellata)*	AH	6
Rhinotea sp.	AH	6
Elateridae		
Agonischius basilaris Candèze	AH	13
Anilicus semiflavus Germar	AH	8
Lycidae		
Metriorrhynchus rhipidius Macleay	AH	13
Mordellidae		
Mordella inusitata Blackburn	AB	13
Mordella leucosticta Guérin	AH	6
Mordella limbata Waterhouse	AB,AF,AH	13
Mordella nr. *limbata* Waterhouse	AH	13
Mordella sydneyana Blackburn	AB,AH	13
Mordella nr. *tristis* Lea	AB,AF,AH	13
Mordella wiburdi Lea	AB	13
Mordella spp.	AB,AH	13
Mordellistena longipes Lea	AH	13
Tomoxia aterrima Macleay	AH	13
Nitidulidae		
Circopes vagans Lea	AH	13
Phalacridae		
Litochrus sp. 1	AH	13
Litochrus sp. 2	AB,AH	13
Scarabaeidae		
Cacochroa gymnopleura Fischer	AB,AH	6,11,13
Cacochroa variabilis (Macleay)	AH	6
Cheiragra ruficollis Macleay	AH	13
Diaphonia dorsalis (Donovan)	AH	4,6
Eupoecila australasiae Donovan	A,AH,AW	1,3,5,6,8,9,11,13
Glyciphana brunnipes (Kirby)	AH	6,13
Glyciphana stolata (Fabricius)	AW	8
Micropoecila cincta (Gory and Perch)	AH	6
Microvalgus nigrinus Macleay	AH	13
Microvalgus nr. *vagans* Lea	AH	13
Polystigma punctatum Donovan	AB,AH,AW	6,8,9,11,13
Phyllotocus australis (Boisduval)	AH	13
Phyllotocus macleayi Fischer	AH,AW	8,13
Phyllotocus marginipennis Macleay	AH	13
Phyllotocus scutellaris Macleay	AB,AF,AH	13
Staphylinidae		
sp.	AH	13

Key: AB = *A. bakeri* — AF = *A. floribunda* — AH = *A. hispida* — AW = *A. woodsiana* — A = *Angophora* spp.